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BUILDING AND VALIDATING INFORMATION SYSTEMS THEORY USING A CASE STUDY SEQUENTIAL EXPLANATORY MIXED METHODS RESEARCH

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Abstract

Building and validating theory in a single study is an important aspect in Information Systems (IS) research. This article discusses how theory can be developed and validated using a sequential explanatory mixed methods case study research. It is based on a critical literature review on mixed methods and case study research. Both mixed methods and case study research embraces multiple paradigms which help to bridge multiple methods and sources of evidence in a single study. The findings from the literature review suggest that sequential explanatory mixed methods case study research may be useful in developing and validating theory in a single study. The article argues that sequential mixed methods case study research enables simultaneously exploring and confirming research questions thereby accomplishing two goals (generating and verifying theory) in the same study. This is very important in research studies which cannot be conducted conclusively using one method to test and explore in depth. This article therefore contributes to our understanding of the complementarity of mixed methods and case study research in developing and validating theory.

Keywords: Case Study Research, Mixed Methods Research, Sequential Explanatory, Concurrent, Exploratory, Triangulation, Paradigm, Pragmatism, Qualitative, Quantitative, Transformative-emancipatory, Critical Realism, Positivist, Interpretivist

1 INTRODUCTION

Building and validating theory in Information Systems (IS) is important like any other disciplines. The main challenge is building and validating theory using a one research method in a single study. This study therefore discusses how to build and validate theory in information systems a case study sequential explanatory mixed methods research. Traditionally the most common categories of research methods are quantitative and qualitative (Oates, 2009). The two traditional research methods have been found to have limitations related to particular research situations such as building and validating theory in a single study. The limitation of the individual traditional approach can therefore be addressed by adopting a mixed methods research approach. The case study sequential explanatory mixed methods research therefore accomplishes two goals of building and validation theory in a single study not afforded by one research method research approach.

Case study research embraces multiple research paradigms which is the use of quantitative and qualitative data in a single study (Eisenhardt & Graebner, 2007). A case study research strategy therefore is suitable for mixed method research which embraces multiple paradigms in understanding phenomena. The case study research pragmatic approach allows utilizing qualitative and quantitative data sources to understand complex phenomena. Case study research provides an opportunity to bridge paradigms through the use of multiple sources of evidence and realities (Mertens, 2009). Creswell et al. (2011) confirms that case study research helps to bridge multiple methods and sources of evidence in a single study. The case study research allows participants exposed to the same environment to participate in the study which is an important factor for the validation process. This study is organized as follows: Section 2 discusses the case study research, Section 3 discusses the mixed methods research approach, Section 4 is the conclusion of the study.

2 CASE STUDY RESEARCH

Yin (2009) defines a case study as “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. Myers, (2009) criticizes Yin’s (2009) definition of case study as being too narrow and too broad at the same time. The definition is more appropriate for positivist case studies as opposed to other methods which do not use propositions like interpretive case studies. A case study is appropriate for explaining relationships in real-life which are too complex for other research strategies (Yin, 2009).

The advantage of case study research as an empirical study is that it is based on a real-life story which can be identified as part of face validity (Myers, 2009). Most of the contemporary issues dealt with in case study research are common real-life situations. The proximity of the researcher to real-life

situations makes it feasible to explore multiple interpretations of the same situation not afforded by other research methods. In addition case study research provides an opportunity of first hand evidence on a particular phenomenon. Yin (2009) points out that case study help the real-life context to be studied from the contextual perspective of which it is part.

2.1 Case Study Research Strategy

The case study research strategy is acceptable in Information Systems (IS) because of its suitability to provide understanding of the relationships between Information Technology (IT) and organisations (Oates, 2009). Rowley (2002) highlights that despite criticisms of case studies; they are widely used as they offer more insights than other approaches. Yin (2009) criticizes some researchers' misconception that case study research is only suitable for the exploratory phase as a preliminary research method. Case studies are useful for explanatory, descriptive or exploratory research to answer the "How" and "Why" questions. Most of the research work undertaken in organisations, specifically addresses issues such as who made what decisions and why these decisions were made (Oates, 2009).

Case study research makes a contribution to knowledge through empirical evidence from real problem situations. Case study research is appropriate at any stage of the research process where the researcher has no control over the contemporary real life situation (Myers, 2009). Case study research strategy's strength is based on multiple data sources (triangulation) and provides an opportunity for the researcher to validate theory in a normally inaccessible phenomenon (Myers, 2009).

2.2 Case Study Research Design

Rowley (2002) comments that one of the contentious questions has been how many cases are sufficient for multiple case studies and there is no simple answer as it depends on the research purpose and question. Yin (2009) points out that case study research can be single or multiple in terms of cases, qualitative, quantitative or both in terms of approach. Case study research may adopt single case or multiple case designs depending on the research objectives and there is no ideal number of cases (Eisenhardt & Graebner, 2007). The four types of designs for case studies are single case (holistic) designs, single case (embedded) designs, multiple case (holistic) designs and multiple case (embedded) designs (Yin, 2009). Whilst Yin (2009) points out that evidence of multiple case studies is more compelling, he urges that the single case study rationale will not be satisfied by multiple case studies.

The case study research method has been found suitable to examine contemporary events without manipulating behaviors and using multiple data collecting techniques (Yin, 2009). Creswell (2003) highlights the view that the methodology and methods used to carry out the research have an influence on the research results. Yin (2009) points out the need for careful investigation before selecting the case study to reduce chances of misrepresentation and problems of inaccessibility.

2.3 Theory Building Using Case Studies

Myers (2009) points to the need for the research to contribute to the knowledge through convincing empirical evidence for other researchers. Case study research is useful for creating knowledge about real life and provides a holistic approach to real life events (Yin, 2009). The case study research differs from other methods on the role to develop theory before conducting any data collection. From a case study perspective, theory development is part of the design phase. Theory development before data collection is important for case study research as it clarifies what is being studied and guides what data to be collected and informs data analysis strategies (Yin, 2009). One way of theory development in case studies is a literature review of the related studies. The literature review can focus on related types of literature from previous studies.

Case studies have been found to be suitable for creating theory and testing existing theory from one or more cases (Yin, 2011). Although case studies are viewed as subjective, the researcher's closeness to data makes it suitable for theory building and its strength is its ability to produce accurate theory from participants involved. Case study research assists to develop theory which can be applied in other situations, possibly using another research strategy (Oates, 2009). In addition to assisting with the data collection design phase, theory development provides the basis for generalizing the case study results. The case study research strategy is suitable for validating theory as it allows same participants to participate in different phases of the study.

2.4 Case Study Research Evaluation

The case study research method has been criticized for lack of rigour due to lack of systematic procedures. The inferiority of case study research can also be due to it being mistakenly associated with case study teaching (Yin, 2009). Case study research has been also criticized for lack of scientific generalization. Researchers have been advised to evaluate case study research based on its fundamental tenets as opposed to using criteria for other methods (Myers, 2009). Myers (2009) points out that many researchers make the mistake of thinking that more case studies increase the validity of the research findings. The notion of sample size to reflect on the whole population is not applicable to case study research. The statistical terms applicable to survey does not mean much to case study research in which more cases are not better than one (Myers, 2009).

Researchers have been criticized also for trying to evaluate all case study research designs in terms of construct validity, internal validity and reliability. The main strength of case study research is the opportunity to use multiple sources of evidence for triangulation in developing converging lines and corroboration. The use of multiple sources of evidence addresses a broader range of issues such as validity, credibility and reliability with multiple measures of the same phenomenon (Yin, 2009). The goal of case study research is not statistical generalization but analytical generalization (to expand and generalize theories). Case studies can be generalized to theoretical propositions and not to populations or universe (Yin, 2009). Therefore, single case study generalization is possible in the same way as a

single experiment is.

3 MIXED METHODS RESEARCH

A mixed methods research approach is a procedure for collecting, analysing and mixing or integrating both quantitative and qualitative data at some stage of the research process within a single study (Creswell, 2003; Mertens, 2009). The mixing that happens at different stages (design, data collection, and analysis stages) is at the core of mixed methods research (Morse & Niehaus, 2009). While the quantitative method (questionnaires surveys) has been found to be economical and efficient in collecting large samples of data, it has weaknesses in investigating social contexts associated with organisations. The qualitative method has been found to be suitable for investigating complex social phenomenon using interviews but has been found to be time-consuming and difficult to use to cover a large group of participants (Morse et al., 2009; Peng, Nunes & Annansingh, 2011).

Mixed methods research helps researchers to design a better research inquiry about a phenomenon than a single method. Leech & Onwegbuzie, (2010) add that although mixed methods research can provide deeper insight into a research inquiry than a single method, not all research inquiries are expected to employ a mixed methods approach. Teddlie et al., (2009) argue that a mixed methods research approach is no substitute for conducting rigorous single method research inquiry. Mixed methods research yields holistic and richer findings to the complex phenomena than any other methods. Mixed methods research helps to resolve the limitation of using a single method design to understand a complex phenomenon.

3.1 Mixed Methods Research Paradigms

Creswell et al., (2011) note the existence of three paradigms for mixed methods research, namely, pragmatism, transformative-emancipatory and critical realism. Some researchers suggest that pragmatism is the most suitable paradigm for justifying the use of mixed methods research (Teddlie & Tashakkori, 2010). The pragmatic approach supports both positivist, (quantitative) and interpretivist (qualitative) approaches in the same research study as part of abduction reasoning. According to pragmatism, the research question dictates the selection of the method and paradigm to be used in the research inquiry.

Venkatesh, Brown and Bala (2013) suggest the paradigm should not to be an obstacle to conducting mixed methods research but focus should be placed on answering the research questions and developing substantive theory for various phenomena through blending of paradigmatic views through conducting rigorous mixed methods research. Creswell et al. (2011) maintain that worldviews in mixed methods research change during a research study, based on the type of design (sequential exploratory or explanatory) and the project phase. Mixed methods research which is part of methodological pluralism allows both positivist and interpretivist epistemologies in a single research inquiry. Mixed methods research, which is the third paradigm, employs quantitative and qualitative

research methods in a single research inquiry through promoting methodological diversity in research inquiry.

3.2 Mixed Methods Research Strength

The mixed methods research rationale is that it optimizes the sample (participant enrichment), maximizes the research instruments, enhances fidelity of instruments, programs or treatments and maximizes the interpretation of the findings (Leech et al., 2010). Mixed methods research provides an escape from the trap of a researcher seeing research as a single design (quantitative or qualitative) instead of benefiting from the best of both worlds. Miles and Huberman (2002) contend that entertaining mixed methods rather than remaining on single design helps quantitative and qualitative inquiries to inform each other in many important ways. The flexibility of mixed methods research is its ability to view theories and testing from both deductive and inductive (testing and developing theory) viewpoints.

Creswell et al. (2011) highlight that mixed methods are suitable for research problems where one data source may be insufficient to provide conclusive results. In mixed methods research where the qualitative data has been used in the first phase, the quantitative is important to generalize and test what was learned from the exploration qualitative phase. In other mixed methods research, one method is embedded in the dominant method to provide an understanding of the research problem. Creswell et al. (2011) also concede that situations exist in mixed methods research in which data collected build on from one method to the other in order to understand the research problem.

3.3 Mixed Methods Research Purpose and Design

The benefits of a mixed methods approach are not always obvious as it serves various purposes in a research inquiry. The main purposes of mixed methods research designs are complementary (combination of results) developmental (results from one informs the other), initiation (results questions other results) and expansion (where results extend breadth and range of inquiry) (Tashakkori & Teddlie, 2003). As such, the mixed methods research must serve one or more purposes in a research inquiry. The clear understanding of the research purposes helps to make informed decisions on the mixed methods design and analysis. Completeness of purpose in mixed methods research provides a holistic view of the phenomenon that cannot be achieved by one approach. A developmental purpose is associated more with a sequential mixed methods approach than a concurrent approach (Tashakkori et al., 2003). The research done by Venkatesh et al. (2013) shows that completeness and being developmental are the most common purposes for conducting mixed methods research.

There are several types and approaches of mixed methods research which have a benefit from the use of both qualitative and quantitative approaches to data analysis and the measurement of meaning. Some of the issues to consider in mixed methods approaches are the timing and ordering of the

methods in the study (Morse et al., 2009). The ordering can be simultaneous (same time) or sequential (different periods). Mixed methods research strategy design can be concurrent (each method independent of each other) or sequential (findings from one method inform the other) to understand a phenomenon (Tashakkori & Teddlie, 2003). The most common types of mixed methods designs are sequential explanatory, sequential exploratory, concurrent triangulation, sequential transformative, concurrent transformative and concurrent nested design (Creswell, 2003; Morse et al., 2009).

3.4 Sequential Explanatory Mixed Methods Design

The sequential explanatory mixed methods design consists of two phases where quantitative data is collected and analyzed in the first phase before qualitative data is collected and analyzed in the second phase (Ivankova et al., 2007; Peng et al., 2011). The first quantitative phase of the study helps to identify the variables and participants for the second qualitative phase as shown in Figure 1. The second qualitative phase of the study therefore helps to explain or elaborate on quantitative results obtained in the first quantitative phase.

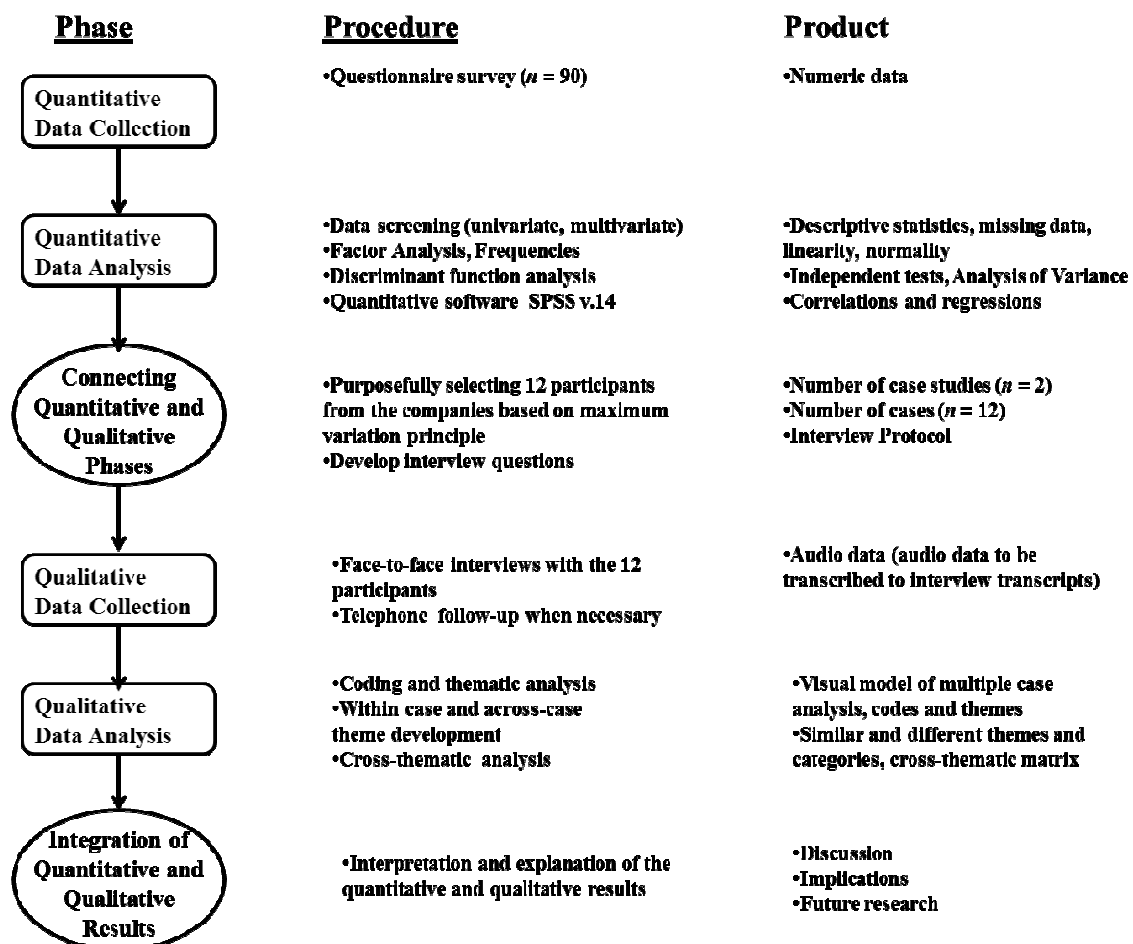


Figure 1. Visual Model for Mixed-Methods Sequential Explanatory Design Procedures (Source: adapted from Ivankova & Stick, 2007 p.98)

3.4.1 Quantitative Phase

Van Voorhis and Morgan (2007) contend that unlike qualitative research, which does not have an agreed sample size, quantitative research offers guidelines on sample sizes needed for different statistical procedures. This means that every quantitative statistical procedure has rules in terms of sample size (see Table 1). Most researchers propose that statistics for detecting differences between or among groups (t-tests, ANOVA) require 30 participants per cell to achieve the minimum suggested power for an ordinary study (Cohen, 1988; Morse, 2000; Ross, 2004). The general rule of thumb for statistics used to examine relationship (correlation and regression) is 50 and above participants (Cohen, 1988; Van Voorhis et al, 2007; Delice, 2010). Some researchers suggest a formula based on the number of independent variables (Delice, 2010). Chi-square, which tests the independence of categorical variables, requires at least 20 overall with no cell smaller than five. Factor analysis requires at least a 300 sample size with 50 participants per factor.

Relationship	Reasonable Sample Size
Measuring group differences (e.g. t-test, ANOVA)	Cell size of 30 for 80% power, if decreased, not lower than 7%?
Relationships (e.g. Correlations, regression)	50 and above
Chi-square	At least 20 overall, no cell smaller than 5
Factor Analysis	300 is good

Table 1. Sample size rules of thumb (Adapted from Van Voorhis and Morgan, 2007)

The descriptive statistics include frequency tables, means, standard deviation and correlations to provide summarized data for discovering trends and patterns (Teddle & Tashakkori, 2009). Descriptive statistics are used to obtain summary indicators from numeric data to describe variable relationships within groups. The descriptive statistics are not sufficient to make inferences about the sample data and hence the need to use inferential statistics methods.

Teddle et al. (2009) concur that inferential statistics, which are normally generated after descriptive statistics, are used to confirm or disconfirm descriptive results. Inferential statistics are used to make inferences from sample data include testing group means, relationships between variables and estimating the degree of error on inferences. Inferential statistics are used to find differences between groups and relationships between variables (Teddle et al., 2009). Significance test between group means and multiple regression analysis help to determine the degree of the relationships between variables. The correlation and regression analysis are conducted to find the relationships and predictor power of constructs and variables.

3.4.2 Qualitative Phase

Many researchers consider qualitative research for its ability to do in-depth investigations on a broad range of research topics (Oates, 2009; Yin, 2011). Unlike quantitative research, qualitative research offers great latitude in selecting research topics without constraints such as research conditions (experiment), unavailability of sufficient data (survey) or adequate sample and studying the past (Yin,

2011). Qualitative research affords the opportunity to study human beings under real-world conditions through what they say (Yin, 2011). Open ended questions have been found more suitable for qualitative research as they allow participants to share their views with the researcher.

Qualitative research focuses on exploring and understanding human social problems. Since human beings have the ability to talk, their behavior and actions are understood by talking to them. Qualitative research reveals participants' perspectives and views and not the meaning held by the researcher. Yin (2011) points out that a researcher needs to acknowledge the existence of multiple interpretations (researchers and participants) in their final analysis. Yin (2011) adds that the possibility of multiple interpretations of the same phenomenon is not a constraint but an opportunity in qualitative research.

The question of how many interviews are enough in qualitative research has remained a thorny issue in the academic profession (Becker, 2012). Most authors concur that the number of interviews depends on many factors (Flick, 2011; Bryman, 2012). Qualitative research has been contrasted with quantitative research which uses correlations to understand objectively what participants do (Becker, 2012; Flick, 2011). Many researchers concur that the "how many" question is answered after reaching saturation and there is no need to continue (Flick, 2011; Becker, 2012). Becker (2012) suggest a sample of between 12 and 60 interviews as a guideline as the number is guided by the methodology and epistemology perspective. Other researchers suggest that interrogating the purpose of the research helps to decide the number of interviews (Flick, 2011; Bryman, 2012). Most researchers concur that there is no rule of thumb as to how many interviews are enough for qualitative interviews (Charmaz, 2008; Flick, 2011; Bryman, 2012). In some cases it is not the sample size that is important but inclusion of a particular case (Becker, 2012).

Becker (2012) suggest a sample size of 12 is sufficient in many cases although they indicate it can vary from one to hundred or more (Flick, 2011). Bryman (2012) suggests five factors to guide the number of qualitative interviews such as saturation, minimum requirements, and theoretical underpinnings of the study, heterogeneity of the population, breadth and scope of research questions. Charmaz (2008) points out that a big sample size does not guarantee the originality of a research contribution. Mixed methods research has been seen as one way to strengthen a study with a small interview sample. A small interview sample has been credited with depth and significance in a study.

3.4.3 Integration of Results

Meta-inferences have been defined as the integration of the quantitative and qualitative research results (Venkatesh et al., 2013). The meta-inferences of quantitative and qualitative analysis offers insightful rich findings as the data is compared before being merged into meta-inferences. The triangulation of different results from qualitative and quantitative phases offers rich insight and method triangulation into the study. The integration of phases helps to achieve design adequacy of

quantitative data (for example, validity and reliability) and qualitative data (credibility) (Venkatesh et al., 2013).

The bridging process of meta-inferences helps to get consensus between quantitative and qualitative findings. Bridging is important in sequential explanatory mixed methods research as it helps to develop and expand the view of the phenomenon of interest. The qualitative research helps to develop plausible theoretical integrative understanding whilst the quantitative deductive process incorporates different development theories. The meta-inferences helped to develop in-depth theoretical understanding and findings which a single method cannot offer (Venkatesh et al., 2013).

3.4.4 Validating Mixed Methods Results

Venkatesh et al. (2013) developed an integrated framework for assisting to validate mixed methods research. The integrative framework provides a holistic insight into the phenomenon of interest by validating quantitative and qualitative studies independently before mixed methods meta-inferences (integrative inferences). The data analysis of mixed methods research is based on the rigorous standards of both the qualitative and quantitative research. The mixed methods data analysis for quantitative and qualitative results is important for credible inferences during analysis.

Reliability of measurement is a precondition of quantitative research validity. Validity enhances the legitimacy of the research findings based on measurement, design and inferential quantitative research (Maxwell, 2004; Teddlie et al., 2009). Descriptive, interpretive and theoretical validity has been found suitable and sufficient to establish reliability in qualitative research. Descriptive validation is similar to design validity, theoretical validity is similar to analytical validity and interpretive validity is similar to inferential validity in the quantitative research method (Maxwell, 2004; Teddlie et al., 2009). Some researchers prefer rigorous treatment of validity in both quantitative and qualitative research (Tashakkori & Teddlie, 2003; Maxwell, 2004; Lee & Hubona, 2009).

4 CONCLUSION

The study suggest that case study sequential explanatory mixed methods research which embraces multiple research paradigms may be useful in developing and validating theory in a single study. It enables simultaneously exploring and confirming research questions thereby accomplishing two goals (generating and verifying theory) in the same study. The case study sequential explanatory mixed methods research helps in bridging multiple methods and sources of evidence in a single study. Therefore it removes the barriers of method adversaries as it provides a bridge to use multiple paradigms as part of pragmatism. The paradigm adversary divide only serves to narrow the choices of approaches available to the researcher. The unrestricting of the research tools provides more evidence on a research problem than the use of one approach. Hence the case study sequential explanatory mixed methods research approach helps to answer questions that cannot be answered by a single approach and together they provide a satisfactory answer.

The rationale of using case study sequential explanatory mixed methods research is to address the research question which cannot be addressed by a single research approach on its own but needs both research methods. The case study sequential explanatory mixed methods research allows participants exposed to the same environment to participate in the study which is an important factor for the validation process. It also enables repeated access to the same participants in the study to get more information about the phenomenon. This helps to answer inconclusive questions and to make the results more credible than they would have been with one research method.

This study therefore contribution to our understanding to some of the benefits of case study sequential explanatory mixed methods research in IS research which may not be possible with one research method. The study revealed that case study sequential explanatory mixed methods research may be useful in building and validating theory in a single study not possible with one research method. Hence, the study encourages IS researchers to consider case study sequential explanatory mixed methods research in building and validating theory. Despite some of the highlighted benefits, the limitation of case study sequential explanatory mixed methods research is the researcher's knowledge of the various data collection techniques. A lack of knowledge results in the loss of the invaluable advantage of case study sequential explanatory mixed methods research. In addition it requires more time from the researcher as it takes time to access organization and analyze the text data.

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